CHAPTER 5: SECOND PAPER FEED SECTION

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LED PSEN Paper sensor
– Lights up when light path is blocked.
Test Mode No. 6 Paper sensor
– Short interval beeps when light path is blocked.

THEORY OF OPERATION

1. Second Paper Feed System

- Rotation of Guide Roller

The Guide cam follower is shifted up and down on the Guide roller cam when the Main motor rotates.

When it follows the cam from the low point to the high one in the cam's rotation after a feeding sheet reach the Guide roller, the Sector gear is driven to rotate the Guide roller gear clockwise.

The Guide roller gear incorporates a one-way spring clutch to rotate the Guide roller only when the Guide roller gear is driven clockwise and not to transmit rotation to the Guide roller when the Guide roller gear rotates counter-clockwise.

- Rotation of Timing Roller

When the Timing roller is raised, the Gear B on the Timing roller shaft is engaged with the Gear A on the Guide roller shaft.

When the Guide roller is rotated, the Timing roller is simultaneously rotated via the Gears A and B to feed a sheet to the print area.

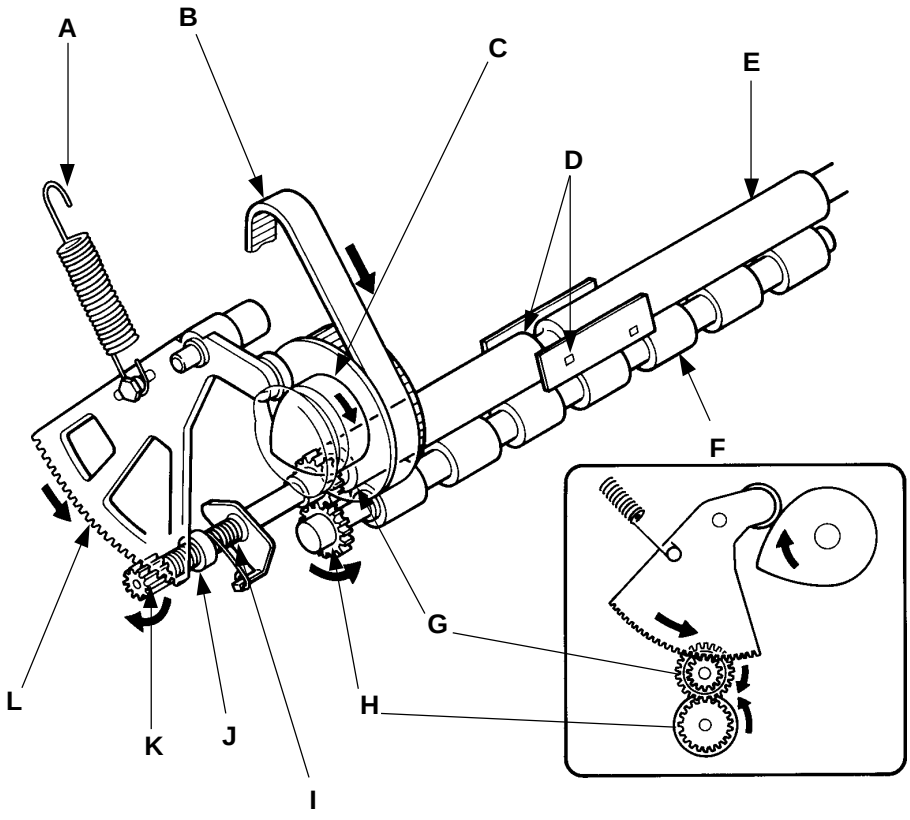
- Check of Paper Feed

The Paper sensor checks if a sheet is securely fed through the Guide and Timing rollers up to the print area.

- Function of Load Spring

The Load spring is put on the Guide roller shaft to prevent the roller from rotating when the rotation force is not transmitted to the roller by applying a load against rotation, which serves constant print position (registration).

A: Sector gear spring
B: Main belt
C: Guide roller cam
D: Paper sensor
E: Guide roller
F: Timing roller
G: Gear A
H: Gear B
I: Load spring
J: One-way spring
K: Guide roller gear
L: Sector gear



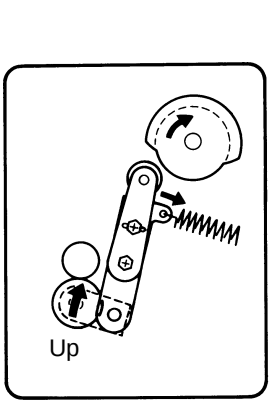
2. Timing Rollor Up Down System

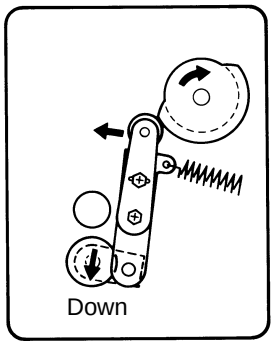
- Shift-up of Timing Roller

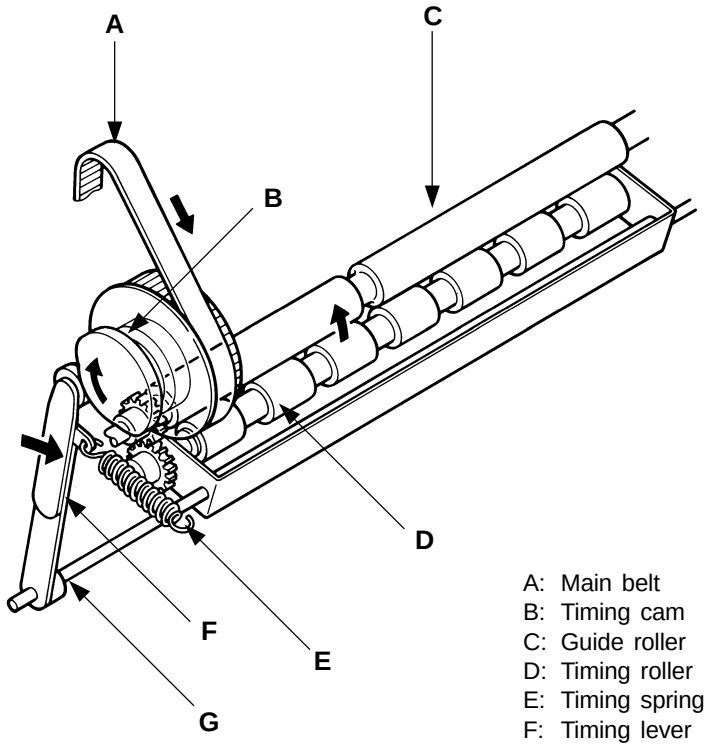
The Timing cam attached to the Cam pulley rotates clockwise when the Main motor rotates. As the Timing cam rotates, the Timing cam follower on the Timing lever, pressed against the cam by the Timing spring, follows the cam and is shifted up and down on the cam.
When it follows the cam from the high point to the low one in the cam's rotation while a sheet is picked up and fed in the first paper feed area, the Timing lever is driven to rotate the Timing roller shaft clockwise, raising the Timing roller mounted on the holder to the Guide roller.
The raised Timing roller is kept in contact with the Guide roller with sufficient pressure by the Timing lever spring.

- Shift-down of Timing Roller

When the Guide and Timing rollers finish rotating and the Timing cam follower follows the cam from the low point to the high one, the Timing lever is driven to rotate the Timing roller shaft counter-clockwise, lowering the Timing roller.
This mechanism prevents the back tension from being applied to the paper.







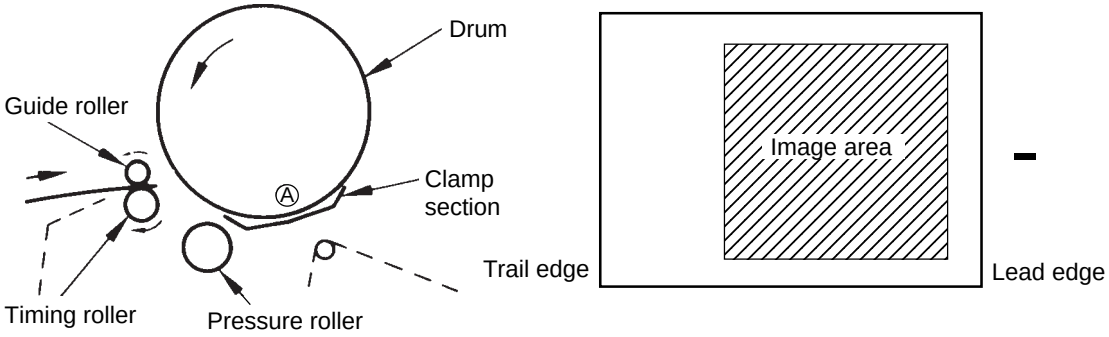
A: Main belt
B: Timing cam
C: Guide roller
D: Timing roller
E: Timing spring
F: Timing lever
G: Timing roller shaft

3. Vertical Position Control System

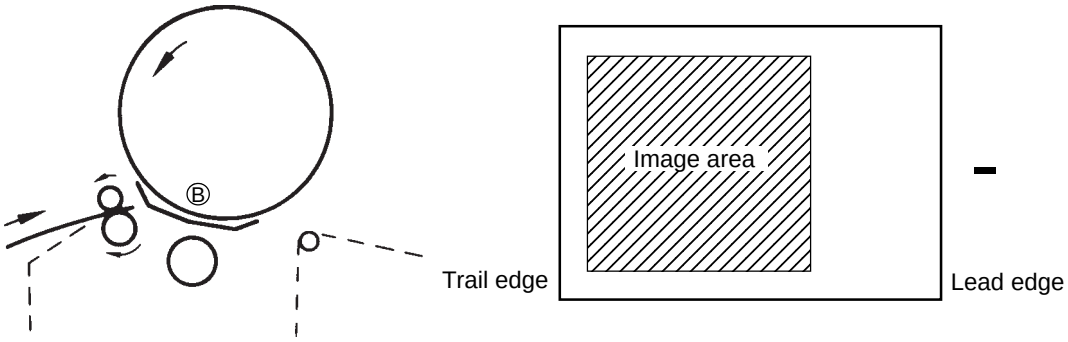
- Basic

When pressing the print position button on the operation panel, the Print positioning motor rotates and changes the vertical print position in steps on the printed copy to a maximum of ±**20mm**.(B4 models)

<1> Suppose the Guide roller starts rotating and feeding a sheet to the print area when the Clamp section on the Drum is rotated to point A in the figure.
In this case, the image area on printed copies is as shown in the figure below.



<2> Next suppose the Guide roller starts rotating and feeding a sheet to the print area when the Clamp section on the Drum is rotated to point B in the figure.
In this case, the sheet is fed earlier and the image area goes down to the bottom of printed copies as shown in the figure below.



The print position in the vertical direction is determined by the start time of the rotation of the Guide roller.

LED TEN Vertical centering sensor
– Lights up when light path is blocked
Test Mode No. 22 Vertical centering sensor
– Short interval beeps when light path is blocked

- Rotation of Print Positioning Motor

When the Print position button "DOWN" on the operation panel is pressed to shift down the image area on printed copies, the Print positioning motor rotates clockwise, causing the Slide shaft to rotate counter-clockwise via the Slide gear.

- Elevation of Slide Plate

By the rotation of the Slide shaft, the Slide shaft bracket, which is fixed to the Slide plate, is elevated to shift up the Slide plate.

- Movement of Main Belt

When the Slide plate is shifted up, the two Slide idlers, which are fixed to the Slide plate to provide tension on the Main belt, are also elevated. This loosens the tension of the Main belt on the upper idler and tightens it on the lower idler, causing the Main belt to move counter-clockwise.

- Rotation of Main Pulley

When the Main belt moves counter-clockwise, the Main pulley is rotated counter-clockwise and the Drum is as well rotated out of the home position.
With the cams and pulleys arranged as above, the Sector gear is started to move earlier, causing the Guide roller as well to start rotating earlier to feed paper to the print area earlier. As a result, the image area is shifted to the bottom on printed copies.

- Shift-up of Image Area

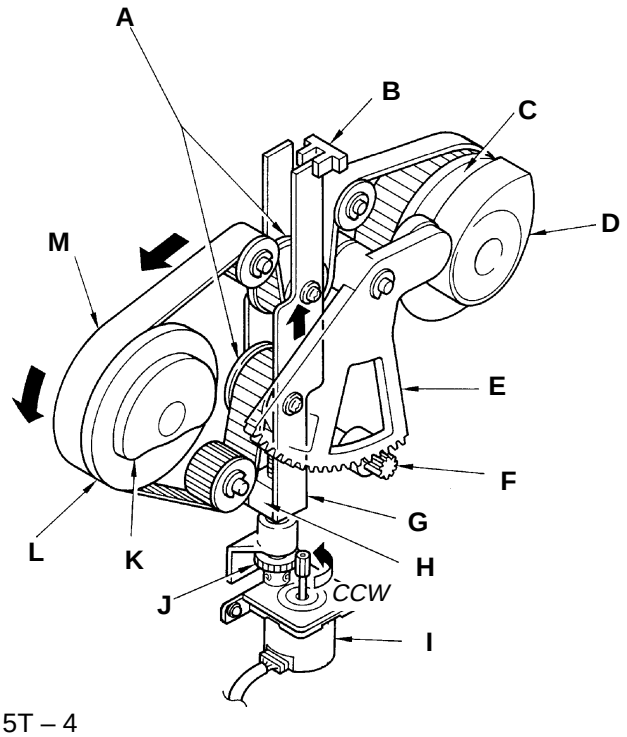
When the Print position button "UP" is pressed, the Print positioning motor rotates counter-clockwise, causing the Guide roller to start rotating later to shift the image area to the top on printed copies (by moving the belt and pulley in the direction opposite to the above case).

- Automatic Print Position Centering

The print position is automatically returned to the center (only vertically) by the Print positioning motor in the following cases: **1)** when the power switch is turned ON, **2)** when the "Centering" button is pressed, and **3)** when the "RESET" button is pressed.
<Mechanism>

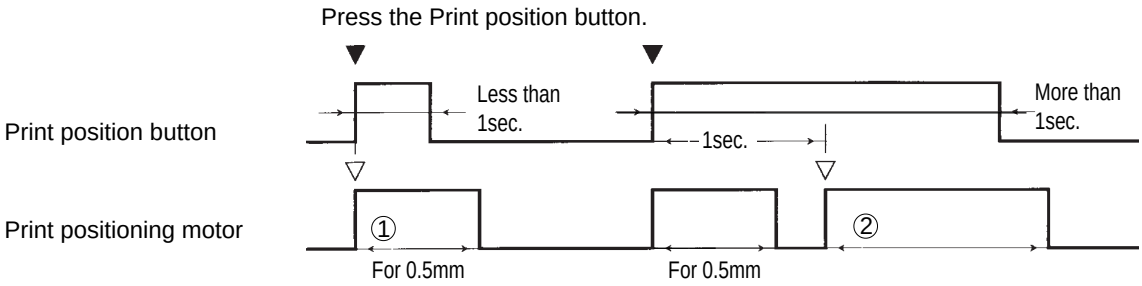
1. If the light path of the Vertical centering sensor is blocked by the Slide plate, the Print positioning motor is rotated until the light path is opened.
2. If the light path of the Vertical centering sensor is open, the Print positioning motor is rotated until the light path is blocked by the Slide plate, and then the motor is rotated in reverse until the light path is opened again.

A: Slide idler
B: Vertical centering sensor
C: Cam pulley
D: Guide roller cam
E: Sector gear
F: Guide roller
G: Slide plate
H: Slide shaft bracket
I: Print positioning motor
J: Slide gear
K: Pressure Cam
L: Main pulley
M: Main belt



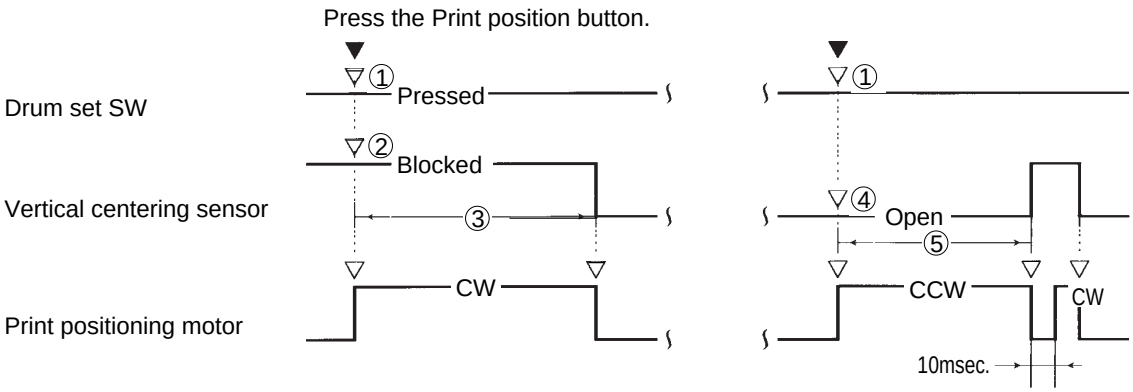
- Timing Chart -

Vertical Position Control System



① If the Print position button is pressed, the Print positioning motor is kept rotating until the print position is shifted by 0.5mm.
② If the Print position button has been pressed for more than 1 sec., the Print positioning motor restarts and keeps rotating (within the range of ±20mm from the center) while the button is kept pressing.

Automatic Print Position Centering Mechanism



① If the Drum set SW is not pressed ON, the Print positioning motor doesn't rotate for the automatic print position centering operation.
② If the light path of the Vertical centering sensor is blocked, the Print positioning motor rotates to lower the Slide plate.
③ If the light path of the Vertical centering sensor has not been opened within **12 seconds** after the Print positioning motor started operating, the machine assumes a Print positioning motor lock has occurred and displays the error code **[T 5]**.
④ If the light path of the Vertical centering sensor is open, the Print positioning motor rotates to raise the Slide plate.
⑤ If the light path of the Vertical centering sensor has not been blocked within **12 seconds** after the Print positioning motor started operating, the machine assumes a Print positioning motor lock has occurred and displays the error code **[T 5]**.

T5(Print Positioning Motor Lock)
- Vertical centering sensor not turned on/off

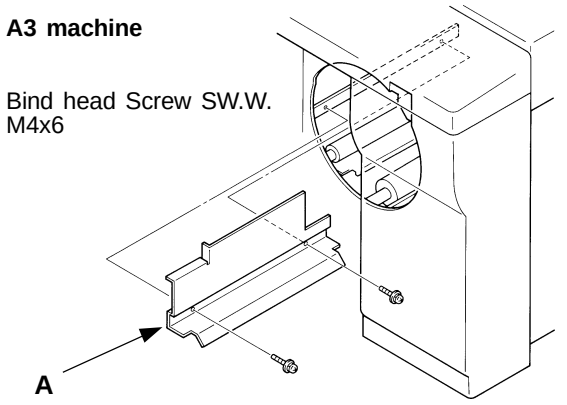
MEMO

REMOVAL & ASSEMBLY

1. Guide Roller Unit

< Removal Procedure >

1. Take out the Drum from the machine, turn OFF the power and remove the Back cover.
2. Remove two mounting screws on the Master removal F cover, and remove the plate(A3 model only).
3. Loosen two mounting screws and remove the Pressure control motor.
4. Remove two mounting screws and washers on the Timing adjustment plate, and remove the plate.
5. Remove the Timing spring.
6. Remove two mounting screws on the Guide roller shaft catch and pull out the Guide roller unit toward the Drive base side.
   [IMPORTANT]
   Be careful not to drop the collar bearing which is inserted into the side frame at the other end of the Guide roller.



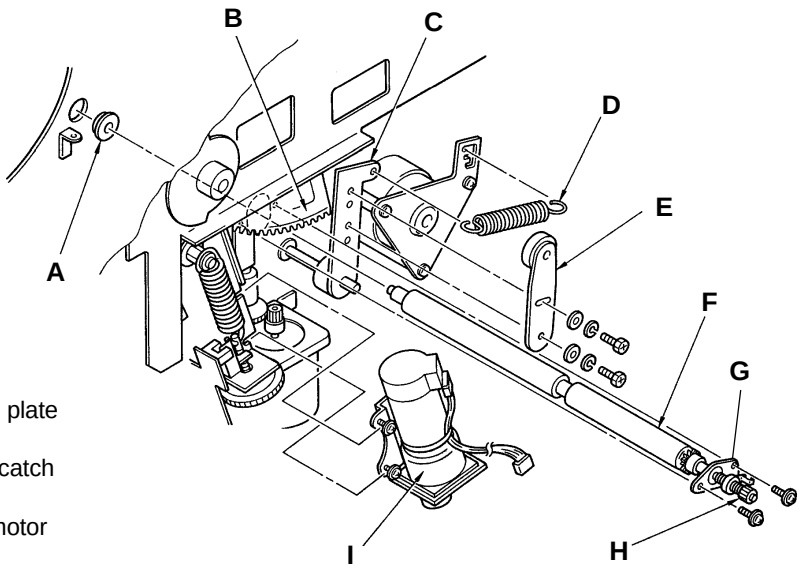
A: Master removal F cover

- Precautions in Assembly -

- Make sure that the Guide roller gear is well but not too tightly engaged with the Sector gear.
- Put grease well on the following parts: Load spring, One-way spring, Sector gear and Guide roller gear.
- Attach the Timing adjustment plate to the upper tapped hole in the Timing lever(see the figure).

- Adjustment after Assembly

- Parallelism of Timing Roller (Page 5A-1)
- Gap adjustment between the Timing lever and Timing cam (Page 5A-2)



A: Collar bearing
B: Sector gear
C: Timing lever
D: Timing spring
E: Timing adjustment plate
F: Guide roller
G: Guide roller shaft catch
H: Guide roller gear
I: Pressure control motor

2. One-way Spring and Load Spring

< Removal Procedure >

- Removal of One-way Spring

1. Remove the drum, turn off the power, and remove the following parts.
   - Back cover
   - (Master removal F cover), Pressure control motor, Timing adjustment plate, Timing spring, Guide roller unit
2. Remove the E-ring at the end of the Guide roller shaft.
3. Remove the Guide roller gear, turning it counter-clockwise (in the direction indicated by the arrow).
4. Remove the One-way spring, turning it counter-clockwise (in the direction indicated by the arrow).

- Load Spring

5. Loosen the allen screws inside the Guide shaft and remove it.
6. Remove the Load spring along with the Guide roller shaft catch, turning them counter-clockwise.

- Reassembly of Guide Roll Unit

1. Hook the Load spring onto the Guide roller shaft catch and fit it into the Guide roller shaft, turning it counterclockwise.
2. Fit in the Guide shaft. Do not tighten screws yet.
3. Fit the One-way spring into the Guide shaft, turning it counterclockwise.
4. Fit the Guide roller gear into the One-way spring, turning it counterclockwise.
5. Fit in the E-ring.
6. Shift the Guide roller gear, one-way spring, and guide shaft lightly to the E-ring side and tighten the two setscrews of the Guide shaft(see Fig. a).

- Checking after Reassembly -

- Move the Guide roller gear manually in the shaft direction to make sure that there is too much movement. Turn the Guide roller gear manually counterclockwise to make sure that it idles.

- Others -

- Apply grease thinly to the section on the Guide roller shaft where the Load spring and One-way spring come into contact with.

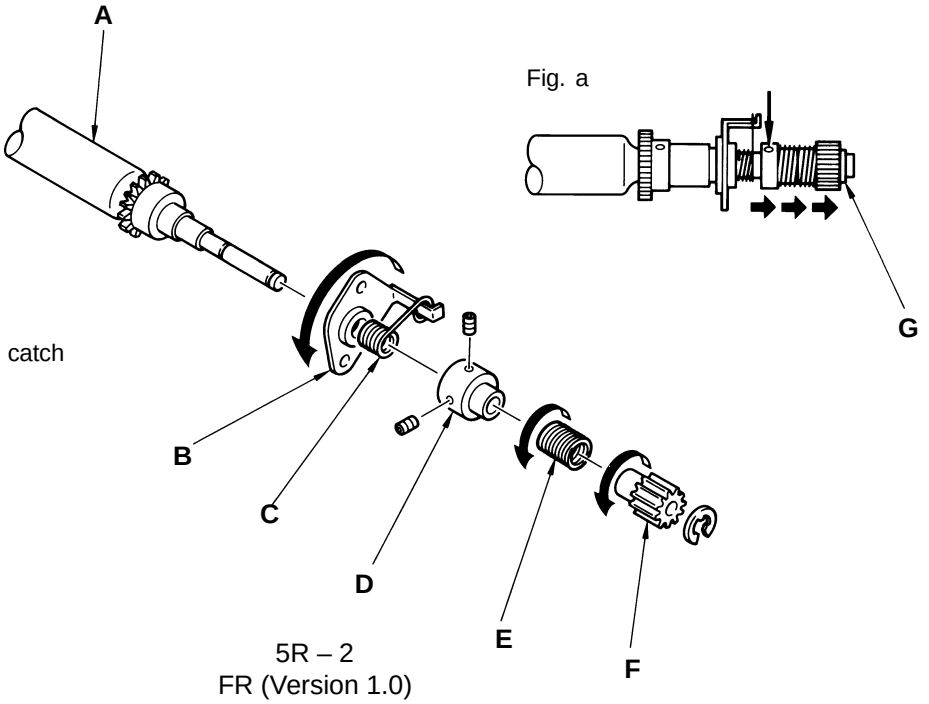


Fig. a

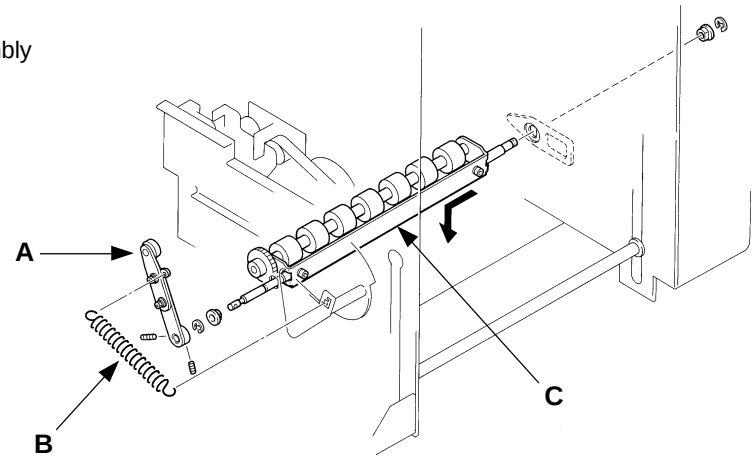
A: Guide roller
B: Guide roller shaft catch
C: Load spring
D: Guide shaft
E: One-way spring
F: Guide roller gear
G: E-ring

3. Timing Roller

< Removal Procedure>

1. Remove the Paper guide plate from the main body(page 5R-4).
2. Remove the Timing spring and Timing lever. Remove the E-rings and metals from both sides of the Timing shaft to detach the Timing roller assembly from the main body.

A: Timing lever
B: Timing spring
C: Timing roller assembly



Disassembly

1. Remove the Timing roller from the main body. (see above)
2. Loosen the screws of the Gear B to remove the gear.
3. Remove the E-rings and metals from both ends of the Timing roller to detach from the Timing roller support plate.

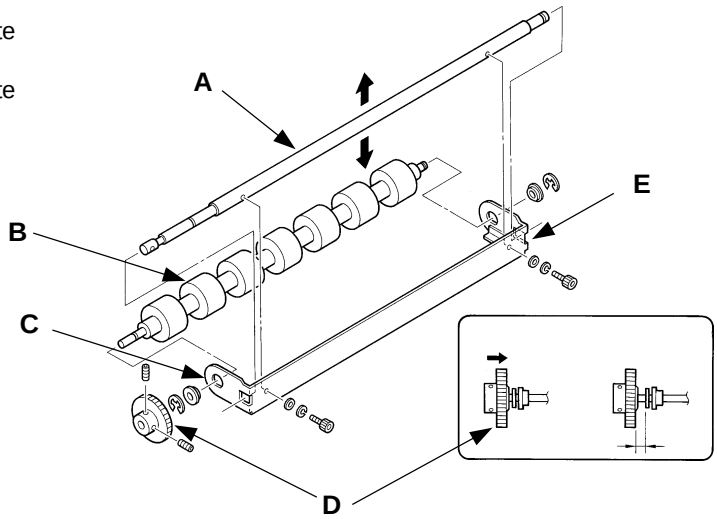
- Precautions in Assembly -

Set the Gear B onto the Timing roller shaft so that outer surface of the Gear B matches to the end of the shaft.

- Adjustment after Assembly -

Parallelism of Timing Roller (page 5A-1)
Gap between Timing Cam and Timing Lever (page 5A-2)

A: Timing roller shaft
B: Timing roller
C: Timing roller support plate
D: Gear B
E: Timing roller support plate



LED PDTC Paper detection sensor
– Light up when reflected light detected.
PTLS Paper size detection sensor
– Light up when reflected light detected.
P-IN Paper feed detection sensor
– Light up when light path is blocked.
PSEN Paper sensor
– Light up when light path is blocked.
Test Mode No.40 Paper feed safety switch
– Short interval beeps when released.

4. Paper Guide Plate

< Removal Procedure >

1. Move the Paper feed tray down to the lowest position, remove the Drum, turn off the power, and remove the following parts.
   - Back cover
   - Paper feed tray unit, paper feed cover, Scraper unit
   - Master removal unit
   - (Master removal F cover for A3 machine), Pressure control motor, Timing adjustment plate, Timing spring, Guide roller assembly
2. Disconnect the connector located on the Drive base side of the Paper guide plate.
3. Remove four mounting screws on the front of the Paper guide plate and two on the top, and take out the Paper guide plate from the machine.

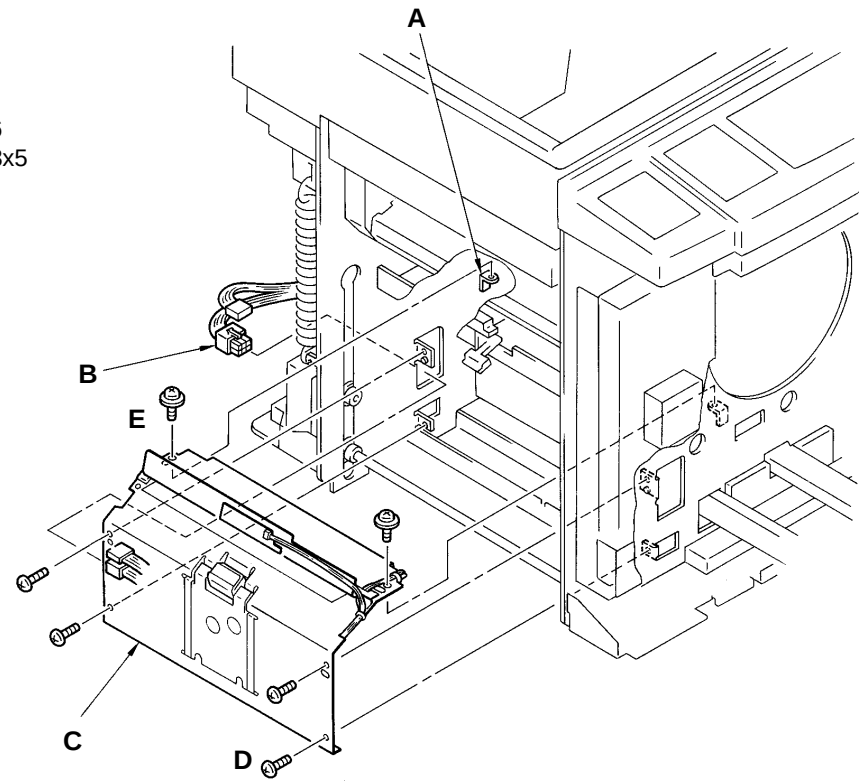
- Precautions in Assembly -

- Place the Paper guide plate on the bracket of the main body.
- If the bracket is moved by mistake, adjust the gap between the Guide plate and Guide roller.
- To adjust the height of the Paper guide plate, insert a 0.8 mm thick iron plate in between the Guide roller and Paper guide plate and fix the left and right brackets.
- Tighten the mounting screws after matching the bosses on the machine frame with the holes on the front side of the Paper guide plate.
- Be careful not to damage the Paper sensor with the Timing roller support plate.

- Adjustment after Assembly -

- Parallelism of Timing Roller (page 5A-1)
- Gap adjustment between the Timing lever and Timing cam (page 5A-2)

A: Bracket(L plate)
B: Connector
C: Paper guide plate
D: Bind-head Screw M4x6
E: Pan-head IT Screw M3x5



LED P-IN Paper feed detction sensor
– Light up when light path is blocked.
PSEN Paper sensor
– Light up when light path is blocked.
Test Mode No.25 Paper feed detection sensor
– Short interval beeps when light path is blocked.
No.6 Paper sensor
– Short interval beeps when light path is blocked.

5. Paper Sensor PCBs (Paper Sensor and Paper Feed Det. Sensor)

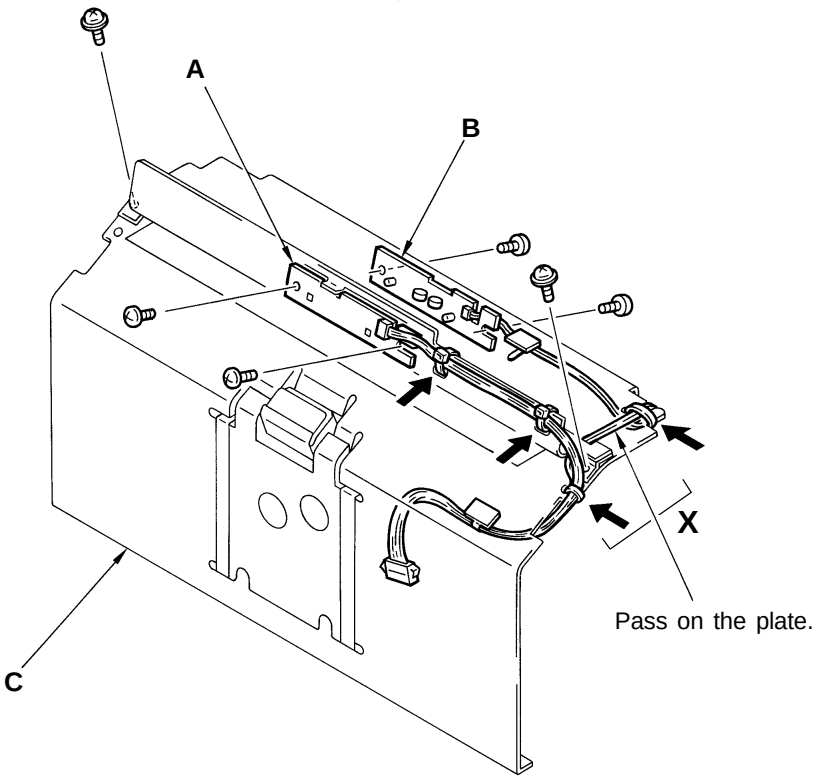
< Removal Procedure >

1. Remove the Paper guide plate, referring to the previous page.
2. Disconnect the connectorof the Paper sensor PCBs and cut the wire clampers holding the wires of the Paper sensor PCBs.
3. Remove two mounting screws on the respective Paper sensor PCBs and remove the PCBs.

- Precautions in Assembly -

- Pass the wires of the Paper sensor PCB (send) on the Paper guide plate when leading them in the X-marked part in the figure below.

A: Paper sensor PCB (Receive)
B: Paper sensor PCB (Send)
C: Paper guide plate



MEMO

ADJUSTMENT

1. Parallelism of Timing Roller

1. Take out the Drum from the machine and remove the Back cover.
2. Cut two strips of paper longways.
   Insert the paper strips through the Paper guide plate and into between the Guide roller and the Timing roller at the two points (a and b) indicated in the figure below.
3. Rotate the drive mechanism until the Timing roller is raised and the paper strips start to feed, by pressing **SW1** on the **System PCB**.
4. By pulling the paper strips toward you, check if they are gripped with equal pressure .
5. If not, loosen the securing screws on the Parallel adjustment plate and collar and turn the adjustment collar to adjust the balance of the Timing roller.

[IMPORTANT]

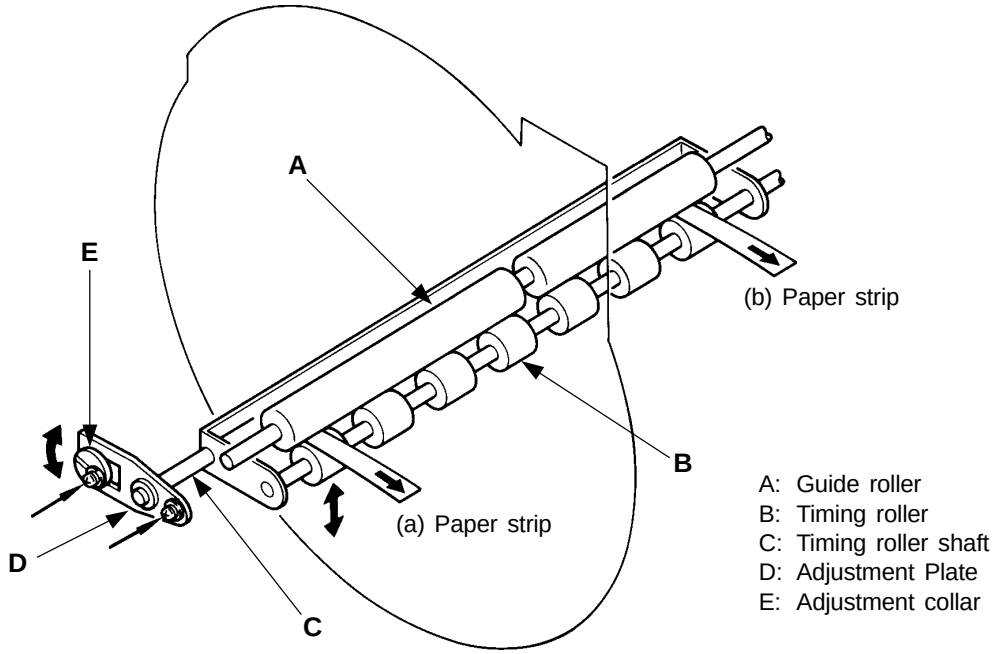
Check that the gap between the Timing cam and the cam follower on the Timing adjustmentplate is correctly adjusted after adjusting the parallelism of the Timing roller.

- Precautions in Adjustment -

- Make sure that paper strips are securely gripped by the rubber rollers of the Timing roller when the Timing roller is raised.

- Results of Misadjustment -

- If the Timing roller is not parallel to the Guide roller;
  paper may be pulled to one side in feeding through the second paper feed section.
  As a result, paper will skew or be wrinkled.



2. Gap between Timing Cam and Timing Lever

2-1 Position of Timing Adjustment Plate

1. Rotate the drive mechanism so that the small round part of the Timing cam faces the cam follower on the Timing adjustment plate, by pressing **SW1** on the **System PCB**.
   Turn OFF the power.
2. Check if the gap between the Timing cam and the cam follower on the Timing adjustment plate is approx. **2.5mm** (for example, by inserting a 2.5mm-thick hexagonal wrench between).
3. If not, loosen two securing screws on the Timing adjustment plate and adjust the position of the plate to get a 2.5mm-wide gap.
4. Tighten the securing screws on the Timing adjustment plate.

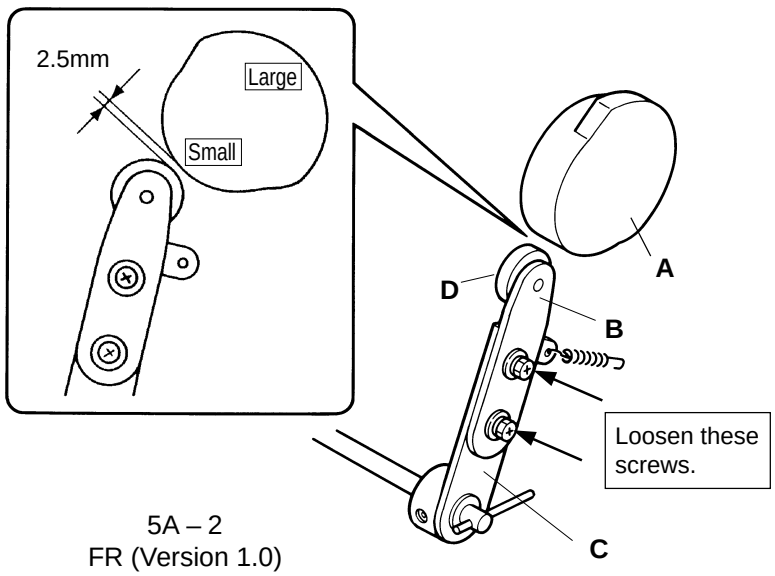
- Precautions in Adjustment -

- If a 2.5mm-wide gap can't be secured by adjusting the position of the Timing adjustment plate or if the Timing adjustment plate can't but be positioned doglegged to secure a 2.5mm-wide gap, adjust the position of the Timing lever before adjusting the position of the Timing adjustment plate.
  (Refer to the following page for the adjustment procedure of the Timing lever's position.)
  [IMPORTANT]
  <u>If the Timing adjustment plate is set doglegged, paper, especially cardboard, may not smoothly feed through the second paper feed section due to the change of the Timing spring's pressure.</u>

- Results of Misadjustment -

- If the gap between the Timing cam and the cam follower on the Timing adjustment plate is narrower than 2.5mm;
  the Timing roller is lowered too much and too early, which causes the Drive gear B to be disengaged from the Drive gear A when the Timing roller is set at the lowest position and shortens the paper feed range from the second paper feed section.
  As a result, a loud scratching noise will sometimes be heard during printing and paper will not feed smoothly through the second paper feed section, especially for the first sample print.
- If the gap between the Timing cam and the cam follower on the Timing adjustment plate is wider than 2.5mm;
  the Timing roller is raised too early and lowered too late.
  As a result, the trailing part of a fed sheet will be caught by the Timing roller, which makes ghost images (double images).

A: Timing cam
B: Timing adjustment plate
C: Timing lever
D: Cam follower

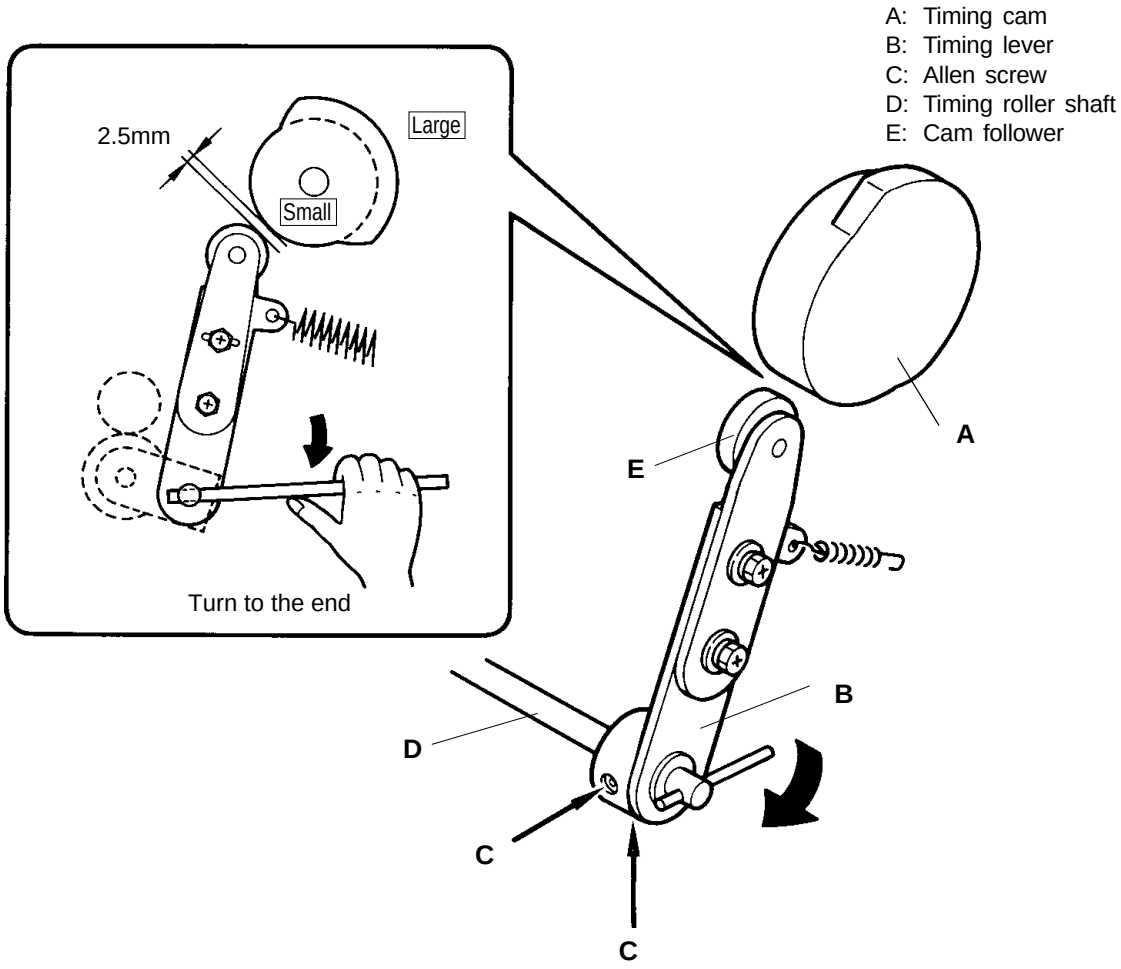


2-2 Position of Timing Lever

1. Check that the Timing adjustment plate is attached to the Timing lever in a line.
2. Rotate the drive mechanism so that the small round part of the Timing cam faces the cam follower on the Timing adjustment plate, by pressing **SW1** on the **System PCB**.
   Turn OFF the power.
3. Loosen two allen screws inside the root of the Timing lever on the Timing roller shaft.
4. Secure a **3mm**-wide gap between the Timing cam and the cam follower on the Timing adjustment plate (for example, by inserting a 3mm-thick hexagonal wrench between).
5. Insert a bar (like an allen key) into the hole at the end of the Timing roller shaft and turn the shaft clockwise to set the Timing roller in close contact with the Guide roller.
   [IMPORTANT]
   Confirm that the Drive gears on the roller shafts engage by moving the Sector gear by hand (to rotate the Guide roller).
6. Holding the shaft in this position, tighten the allen screws inside the root of the Timing lever.
7. Adjust the position of the Timing adjustment plate to change the gap between the Timing cam and the cam follower on the Timing adjustment plate to **2.5mm**, referring to the previous page.

- Precautions in Adjustment -

- Secure the Timing lever in the way it does not get in contact with the Main shaft face plate and Sector gear.



3. Vertical Print Position

There are two kinds of adjustment procedures for the vertical print position depending on the degree of difference in image position between an original and a printed copy as follow.

- If the difference is **less than 12mm**; → Adjust **(1) Position of Guide Roller Cam**.
- If the difference is **12mm or more**; → Adjust **(2) Arrangement of Main and Cam Pulleys**.

[IMPORTANT]

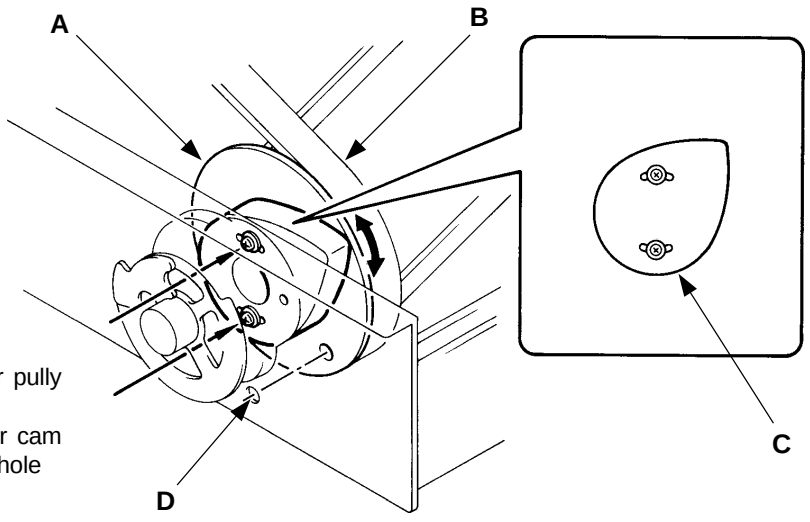
Remember that the following adjustment should be applied after confirming that the master-making and -loading positions are correct.

(1) Position of Guide Roller Cam

1. Check that images are transferred into the correct area on a master and the master is correctly loaded on the Drum.
   If no error is found in the master-making and -loading operations, make a new master with Test chart as an original.
2. First move the print position toward the bottom by the Print position button and return it to the center by the "Centering" button. Then print **5 to 10** copies at **speed 3**.
3. Check if a degree of discrepancy of registration between on the original and on printed copies is within allowance. The allowance is **±5mm**.
4. If it is beyond the allowance but **within12mm**, loosen two mounting screws on the Guide roller cam and adjust the installation position of the cam.
   [Note]
   - If the cam is moved clockwise, → the print position is shifted toward the bottom.
   - If the cam is moved counter-clockwise, → the print position is shifted toward the top.
5. Tighten the mounting screws on the Guide roller cam and check the print position by repeating the procedure in the step 2 above.

- Precautions in Adjustment -

- Don't loosen the mounting screws on the Timing cam. If they are loosened by mistake, secure them at the middle of the long hole.
- Move the Guide roller cam a little by a little because the vertical print position will be changed by more than 12mm only by adjusting the Guide roller cam's installation position.



A: Main motor pully
B: Main belt
C: Guide roller cam
D: Alignment hole

(2) Arrangement of Main and Cam Pulleys

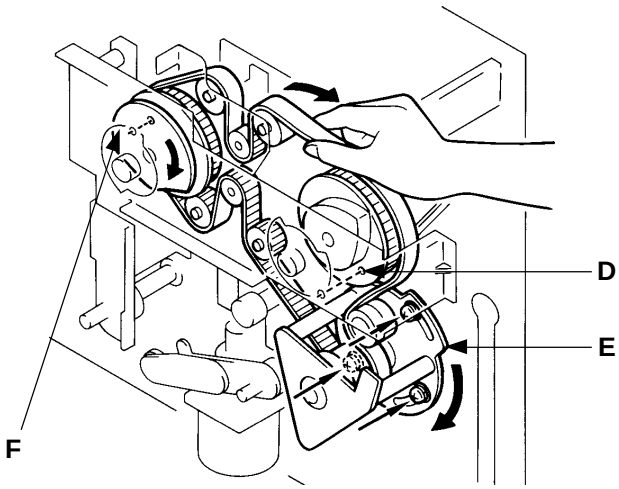
1. Return the print position to the center by the "Centering button and rotate the Drum to the home (A-plate detection) position.
2. Turn off the power and unhook the elevator spring from the drive side. Disconnect the connector of the Motor control PCB and ground wire. Remove three mounting screws to remove the unit.
3. Check if the holes on the Main shaft face plate are aligned with the counterparts on the Main pulley and Cam pulley.
4. If not, loosen three mounting screws on the Paper feed clutch base and turn the Paper feed clutch unit clockwise to release the tension of the Main belt.
5. Hold the main belt like pulling it. Turn the main pulley to align the alignment hole.
6. Turn the Paper feed clutch unit counter-clockwise to apply tension to the Main belt. Tighten the mounting screws on the Paper feed clutch base while applying tension.
   [Note]
   When applying tension to the Main belt, the Cam pulley alignment hole will move down a little or the Main pulley alignment hole will move up a little.
7. Attach the Motor control PCB and Elevator spring, and check a vertical print position.
8. Check the hole alignment once more to confirm the correct arrangement of the Main and Cam pulleys.
   After confirming the correct arrangement of the pulleys, check the print registration following the adjustment procedure of the Guide roller cam's installation position.
   (Refer to the previous page.)

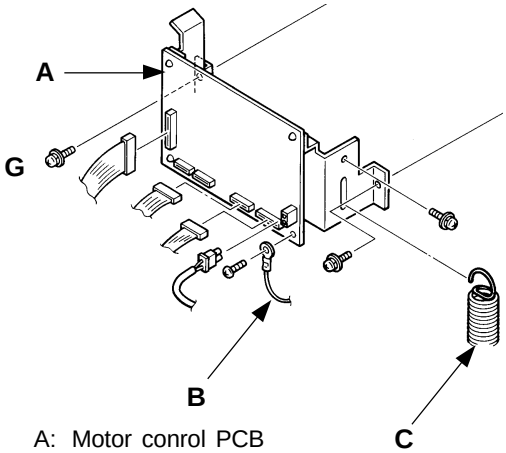
- Adjustment after Assembly

- Position of the P Disc (Page 4A-5)

- Results of Misadjustment -

- If the Guide roller cam is not positioned correctly or the Main and Cam pulleys are not correctly arranged ;
  1) the print registration will still be incorrect.
     The print position is shifted about 12mm by one-gear-tooth discrepancy of the arrangement of the Cam pulley.
  2) paper will not feed properly and jam in the second paper feed section.
  3) printed paper will stick on the drum.





A: Motor conrol PCB
B: Ground wire
C: Elevator spring
D: Alignment hole(Main pulley)
E: Paper feed clutch base
F: Alignment hole(Main shaft and Pressure cam)
G: Pan-head Screw SW. W M4x6

4. Position of Timing Cam

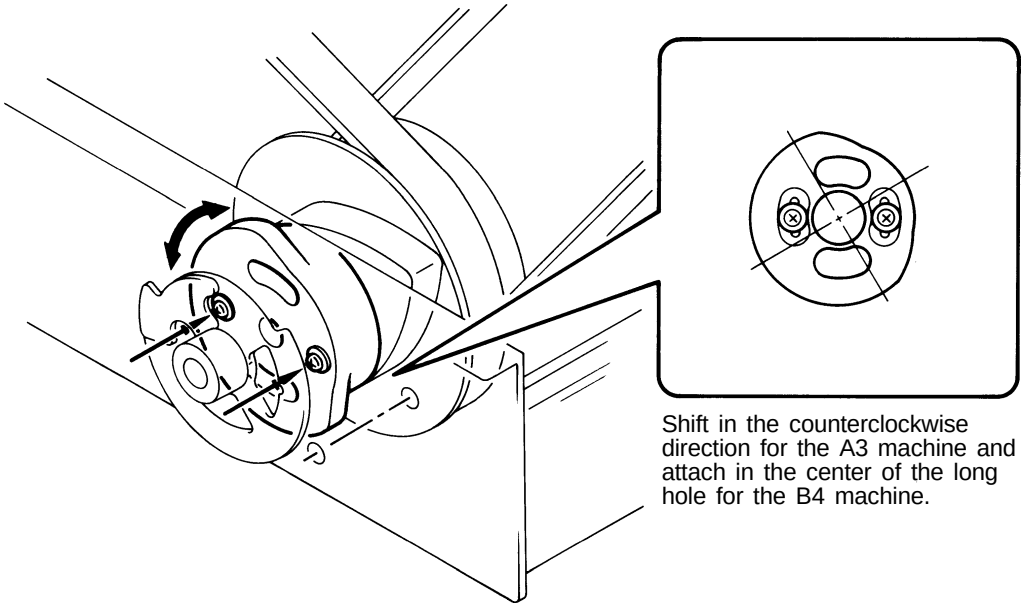
This adjustment is required only when the position of the timing cam was moved, mistaking it for the guide roller cam. It is subjected that the gap between the timing lever and timing cam has been properly adjusted.

- Adjustment and Checking

1) Attach the Timing cam to the following position.
   For the A3 machine —— Shift in the counterclockwise direction to attach.
   For the B4 machine —— Attach in the center of the mounting hole.
2) Make a master with A3-size original for the A3 machine and a B4-size original for the B4 machine, and print on the A3-size paper.
3) Make sure that there are no ghosts, even if the vertical print position is maximumly shifted either “upward” or “downward.”
4) If there is any ghost, loosen the setscrews of the Timing cam and move it in the following directions to make adjustment.
   - When the ghost appears at the beginning of the paper —— Shift the Timing cam in the clockwise direction.
   - When the ghost appears at the end of the paper —— Shift the Timing cam in the counter-clockwise direction.

- Result of Misadjustment -

If the Timing cam is dislocated in the clockwise direction, the paper may not reach the press roller due to earlier release timing of the Timing roller, displaying “PAPER JAM. CHECK PAPER FEED AREA.”
The contact timing of the Timing roller may become earlier, catches the rear end of the sheets of paper during printing, applies the back tension, thus causing the ghost.
On the contrary, if the Timing cam is dislocated in the counterclockwise direction, the release timing of the Timing roller may be delayed, and the back tension may be applied catching the paper despite that printing has begun with the press roller, thus causing the ghost.



Shift in the counterclockwise direction for the A3 machine and attach in the center of the long hole for the B4 machine.